

Application No. 10/583182
Response to the Office Action dated December 2, 2008

REMARKS

Favorable reconsideration of this application is requested in view of the following remarks.

Claim 1 has been amended to include the lower limit of the sulfonic acid content in polymer (B) as supported by the specification page 8, lines 21-24. Claim 8 has been amended to clarify that the drawn yarn of polymer A and polymer B is subject to the relaxation treatment carried out between the drawing and dyeing as supported by the specification at page 12, lines 3-15 and production examples, for example, production examples 2, 5, 8, 10, 14, and 16 at pages 18, 20, 21-22, 22, 24, and 25, respectively. Claims 5-7 and 10-18 have been amended editorially.

Claim 19 has been added as supported by production examples 1-2, 7-10, and 13-18 in the specification (see tables 1 and 2 at page 27 and 30, respectively).

Claims 1-7 and 9-18 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5 and 8-14 of copending Application No. 11/632,604. Applicants file herewith a terminal disclaimer over Application No. 11/632,604. Therefore, the rejection is moot and should be withdrawn. Applicants do not concede the correctness of the rejection.

Claims 1-7 and 9-18 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 20 of copending Application No. 11/667,633. Applicants file herewith a terminal disclaimer over Application No. 11/667,633. Therefore, the rejection is moot and should be withdrawn. Applicants do not concede the correctness of the rejection.

Claim 8 has been rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Applicants respectfully traverse this rejection.

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Claim 8 requires that the drawn yarn of polymer A and polymer B is subject to the relaxation treatment and that the treatment is carried out between the drawing step and the dyeing step. Accordingly, claim 8 is clear and definite, and this rejection should be withdrawn.

Claims 1-7 and 9-18 have been rejected under 35 U.S.C. 102(b) as being anticipated by Ono et al. (Japanese Patent Application Publication No. 02-182916). Applicants respectfully traverse this rejection.

Ono discloses a flame retardant composite fiber obtained by jointing components A and B (see abstract). Ono discloses that polymer (B) (which is expressed as polymer (II) in Ono) includes 0-10 wt% of a sulfonic acid-containing monomer (*id.*) and fails to disclose that the sulfonic acid-containing monomer content in polymer (B) is 10-40 wt% of the sulfonic acid-containing monomer as claim 1 requires. In addition, Ono discloses that when the sulfonic acid-containing monomer content in polymer (B) exceeds 10 %, during blending and cospinning the two polymers, elution of the polymers increases and difference of dyeabilities between polymer (A) and polymer (B) increases, and that the difference causes non-uniform appearance of the fiber (see page 3 (p. 101), upper right coln. of the original publication). In contrast, when polymer (B) of the fiber contains 10 wt% or more of a sulfonic acid containing monomer as claim 1 requires, polymer (A) and polymer (B) tend to be incompatible with each other, i.e., phase separation of the spinning solution of the mixture of the polymers occurs, and the incompatible spinning solution provides the fiber with a low shrinkage during a dyeing process (see page 8, lines 21-24 and page 10, lines 16-19 of the specification).

Moreover, in Ono, polymer (A) and polymer (B) are jointed but not mixed (see page 3 (p. 101), at lower left coln.) and form a fiber with a side-by-side configuration (example 1 at page 5 (p. 103), upper left coln.), for which polymer (A) solution and polymer (B) solution are introduced to a side-by-side type spinneret from separate inlets, or a sheath-core type fiber, for which polymer (A) solution and polymer (B) solution are introduced to a sheath type spinneret so that polymer (A) and polymer (B) are introduced to a sheath part and a core part of the spinneret, respectively (example 2 at page 6 (p.

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104), upper left coln.). Thus, Ono does not disclose a fiber produced from a spinning solution that includes a mixture of both polymer (A) and polymer (B) as claim 1 requires.

Further, Ono is silent about properties such as the particle size of phase separated spinning solution, the shrinkage, and the relative saturation value. Because the content of sulfonic acid-containing monomer in polymer (B) of claim 1 is different from that of Ono, there is no reasonable basis to assume that the properties of claims 4-7 and 9-18 are the same as those of Ono.

Accordingly, claims 1-7 and 9-18 are distinguished from Ono.

Claims 1-7 and 9-18 have been rejected under 35 U.S.C. 102(b) as being anticipated by Ueno et al. (Japanese Patent Application Publication No. 06-158422). Applicants respectfully traverse this rejection.

Ueno discloses a flame retardant shrinkable fiber made of polymers (I) and (II) and that polymer (II) includes 2-5 wt% of a sulfonic acid-containing monomer (see abstract). Ueno further discloses that when the content of the sulfonic acid-containing monomer exceeds 5 wt%, %, elution of the polymers to the bath during blending and spinning the two polymers increases and difference of dyeabilities between the flame retardant shrinkable fiber and the other acrylic fibers increases, and that such difference causes non-uniform appearance of a fiber when the fiber of Ueno is mixed with the other fiber (see para. [0017]). Thus, Ueno fails to disclose polymer (II) that includes 10-40 wt% of a sulfonic acid-containing monomer as claim 1 requires.

In addition, like Ono, Ueno is silent about properties such as the particle size of phase separated spinning solution, the shrinkage, and the relative saturation value. Because the content of a sulfonic acid-containing monomer in polymer (B) of claim 1 is different from that of polymer (II) of Ueno, there is no reasonable basis to assume that the properties of claims 4-7 and 9-18 are the same as those of Ueno.

Accordingly, claim 1 is distinguished from Ueno, and this rejection should be withdrawn.

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Claim 8 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno et al. (Japanese Patent Application Publication No. 06-158422) in view of Sudo et al. (U.S. Patent Application Publication No. 2002/0122937). Applicants respectfully traverse this rejection.

Claim 8 is distinguished from Ueno for at least the same reasons as discussed for claim 1 above. Sudo discloses a hollow shrinkable fiber that includes 30-80 wt% of acrylonitrile and 20-70% of a monomer such as a halogen-containing vinyl monomer (see abstract and para. [0007] at page 1-2). Sudo, however, does not disclose that the fiber is made of two polymers A and B, each of which includes the particular content of a sulfonic acid-containing monomer as claim 1 requires. Thus, Sudo does not remedy the deficiencies of Ueno. Accordingly, claim 8, which ultimately depends from claim 1, is distinguished from Ueno in view of Sudo, and this rejection should be withdrawn.

In view of the above, Applicants request reconsideration of the application in the form of a Notice of Allowance.

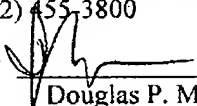


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DPM/my/ad

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(page 101; column 2, line 1 to column 3, line 10)

In the present invention, examples of the sulfonic acid-containing monomers contained in the polymer (II) include those of the polymer (I). The sulfonic acid-containing monomer of the polymer (I) may be same as that of the polymer (II), or two kinds or more of the sulfonic acid-containing monomers may be combined. The content of the sulfonic acid-containing monomer contained in the polymer (II) is preferably 0 to 10% by weight. The sulfonic acid-containing monomer of more than 10% by weight increases a polymer eluted into a coagulation bath upon being blended and conjugate-spun, and causes a large difference in the stainabilities of A and B components of the obtained fiber to cause fluctuation.

The mixed rate of the polymer (II) to the polymer (I) of the B component in the present invention is preferably 5 to 40 parts by weight, more preferably 7 to 30 parts by weight, and still more preferably 10 to 25 parts by weight. The polymer (II) of less than 5 parts by weight causes insufficient appearing number of crimp of the fiber obtained by conjugate-spinning both the A and B components. The polymer (II) of more

than 40 parts by weight increases the conglutination of the fiber obtained by conjugate-spinning both the A and B components, excessively increases the appearing number of crimp of the fiber, and impairs texture in being mixed and used.

In the present invention, the joint form of the A and B components is not particularly limited to a side-by-side type and a sheath core type or the like. In spinning using a sheath core pipe sleeve, the A and B components are respectively any of a sheath part and a core portion. However, it is preferable that the core portion has lower heat resistance since the conglutination or the like between the fibers is reduced. The joint ratio of the A and B components is not particularly limited as long as excellent crimp appears. However, the joint ratio of the B component to one part of the A component is preferably 1/5 to 5 parts.

(page 102, column 4, line 6 to the end)

Example 1

A polymer having a composition of acrylonitrile (hereinafter, abbreviated as AN) : vinylidene chloride (hereinafter, abbreviated as VDC) : sodium allylsulfonate (hereinafter, abbreviated as SAS)= 55:43:2 (%) was polymerized in an autoclave using dimethylformamide (hereinafter, abbreviated as DMF) as a solvent. The unreacted monomer was removed and recovered by evaporating the polymerized dope using a rotary evaporator. A polymer solution after the monomer was recovered was transparent light yellow and was in a viscous state. A spinning concentrate solution of the polymer (I) having a polymer concentration of 23.5% and a

water content of 4.5% was obtained.

Next, AN, methyl methacrylate (hereinafter, abbreviated as MMA), and sodium-2-acrylamide-2-methyl-propanesulfonate (hereinafter, abbreviated as SAM) were dissolved in DMF, and were then polymerized in the autoclave.

Then, the viscous polymerized dope of transparent light yellow obtained by removing and recovering the unreacted monomer was diluted with DMF to obtain a concentrate solution of a polymer (II) having a polymer concentration of 23.5%. The concentrate solution of the polymer (II) was mixed with the spinning concentrate solution of the polymer (I) so that the weight ratio of each of the polymers was set to a ratio shown in Table 1. Thereby, a spinning concentrate solution having B component was obtained.

The polymer (I) was used as the A component. The spinning concentrate solutions of the A and B components were respectively introduced into a side by side type composite spinning pipe sleeve (nozzle hole diameter: 0.06 mm, number of holes: 4000) from another inlet, and were spun into a coagulation bath of 18°C. In the coagulation bath, a ratio of DMF to water was 53:47 (%). The ratio of discharging amounts of the A and B components was 1:1. The spun fiber was subjected to primary stretching of 4.5 times in two baths having DMF concentrations sequentially reduced to 30% and 15% using a stopping bathing agent. The fiber was then sufficiently rinsed in a rinsing tank of 70°C. An oil agent adhered on the fiber in a pre-oil tank. The fiber was dried and densified by a hot roller of 135°C. After the fiber was dried, the fiber was subjected to secondary stretching of 1.4 times under a steam heat condition of 100°C and strain

contraction of 0.95 times under a steam heat condition of 100°C. The fiber was subjected to post oil adhesion and crimp application. The fiber was then dried to obtain various flame resisting acrylic composite fibers of 3 deniers.

The fiber obtained in the present example had excellent texture, bulkiness and flame retardance.

Table 1

Test No.	B Component		Flame retardance (LOI)	Conglutination of fiber	Physical properties after crimp appears		Note
	Polymer (II) composition	Polymer (II) additive amount (%)			Stainability	Number of crimp (pieces/inch)	
1	-	0	30	○	○	0	Comparative example
2	50/50/0	5	30	○	○	8	The present invention
3	"	10	29	○	○	15	The present invention
4	"	20	28	○	○	26	The present invention
5	"	30	27	○	△	35	The present invention
6	"	40	26	△	△	42	The present invention
7	"	50	25	×	△	51	Comparative example
8	48/50/2	20	28	○	○	27	The present invention
9	45/50/5	20	28	○	○	28	The present invention
10	40/50/10	20	28	△	△	30	The present invention
11	85/50/15	20	28	×	×	33	Comparative example
12	25/75/0	20	28	×	△	39	Comparative example
13	60/40/0	20	28	○	○	23	The present invention
14	80/20/0	20	28	○	○	4	Comparative example

Example 2

A polymer (II) having a composition of Table 2 was polymerized in an

autoclave. An unreacted monomer was then removed and recovered to obtain a spinning concentrate solution of the polymer (II) having a polymer concentration of 23.5%. 20% of the concentrate solution of the polymer (II) was added into the spinning concentrate solution of the polymer (I) obtained in example 1, and the solutions were mixed to obtain a spinning concentrate solution having B component.

The polymer (I) was used as the A component. The A component was introduced into a sheath portion, and the B component was introduced into a core portion by using a core sheath composite pipe sleeve. The polymer (I) was wet-spun in a coagulation bath of 25°C. In the coagulation bath, a ratio of DMF to water was 60:40. The ratio of discharging amounts of the A and B components was 1:1. The spun fiber was subjected to primary stretching of 4.5 times in two baths having DMF concentrations sequentially reduced to 30% and 15% using a stopping bathing agent. The fiber was then sufficiently rinsed in a rinsing tank of 70°C. An oil agent adhered on the fiber in a pre-oil tank. The fiber was dried and densified by a hot roller of 135°C. After the fiber was dried, the fiber was subjected to secondary stretching of 1.4 times under a steam heat condition of 100°C and strain contraction of 0.95 times under a steam heat condition of 100°C. The fiber was subjected to post oil adhesion and crimp application. The fiber was then dried to obtain various flame-retardant acrylic composite fibers of 3 deniers.

The fiber obtained in the present example had excellent texture, bulkiness and flame retardance.

Table 2

Test No.	Composition of polymer (II)		Flame retardance (LOI)	Conglutination of fiber	Physical properties after crimp appears		Note
	Monomer composition	Weight ratio			Stainability	Number of crimp (pieces/inch)	
1	AN/VCl/SAM	35/60/5	30	○	○	32	The present invention
2	AN/MA/SAM	47/50/3	28	○	○	29	"
3	AN/HEMA	50/50	28	○	○	28	"
4	AN/GMA	50/50	28	○	○	28	"
5	AN/VCl/HAAm	40/40/20	29	○	○	30	"

VCl: Vinyl chloride, MA: Methyl acrylate, HEMA: 2-hydroxyethyl methacrylate,
GMA: Glycidyl methacrylate, HAAm: Methacrylamide

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[0007]

Japanese Patent Application Laid-Open Publication No. 55-168207 presents a flame-retardant acrylic synthetic fiber having a shrinkage ratio of 20% or more, and preferably 30% or more. The flame-retardant acrylic synthetic fiber is obtained by spinning a mixture of an acrylonitrile (hereinafter, referred to as AN) polymer of 40 to 60 parts by weight and a flame-retardant acrylic polymer of 60 to 40 parts by weight, the acrylonitrile and flame-retardant acrylic polymers being not compatible with each other. In the present inventors' findings, the polymers are extremely and remarkably phase-separated in the spinning of the mixed polymer having such a large ratio. The spinning causes the reduction in heat resistance, the generation of voids, the increase in the conglutination of the fiber caused by the generation of voids, and the reduction of qualities such as operability, stainability and strength, and thereby the fiber capable of being practically used cannot be obtained.

[0017]

The amount of the sulfonic acid-containing monomer contained in the polymer (II) is 2 to 5% by weight. The sulfonic acid-containing monomer of more than 5% by weight increases the polymer eluted into the coagulation bath upon being blended and spun, and produces a large difference between the stainability of the obtained fiber and that of other ordinary acrylic synthetic fiber or flame-retardant acrylic synthetic fiber to cause fluctuation or the like in being blended and used.